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Reproductive biology of *Thryonomys swinderianus* (Temminck)

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Abstract

Research done on female cane rats led to the assumption that a vaginal closure membrane does not occur in these animals. These results are in contrast to evidence in the literature. Changes in the vulva as well as a periodical appearance of a vaginal scab could not be brought into connection with the oestrous.

♀♀ with "open vagina" and "secretion" showed no lordose-reaction.

Introduction

We have attempted to show a possible correlation between the visible conditions in the vagina and the related state of oestrous in the cane rat – *Thryonomys swinderianus* –, similar to the changes in the anogenital region during oestrous, which can be observed in a number of myomorph and sciurormorph rodents.

1812 LE GALLOIS (quoted by WEIR 1974) first described a vaginal closure membrane in the guinea-pig (Caviidae), a species, which, as *T. swinderianus* also belongs to the suborder Hystricomorpha (THENIUS 1980). This membrane has been described by STOCKHARD and PAPANICOLAOU (1919) as an almost transparent epithelial cellular membrane. They also proposed a direct correlation between the periodical appearance and disappearance of the vaginal closure membrane and the oestrous of the guinea-pig.

WEIR (1974) has shown that 29 of 30 observed hystricomorph rodents possessed the vaginal closure membrane and ASIBEY (1974) confirmed the existence of a vaginal closure membrane in pregnant females of *T. swinderianus*.

ODUOR-OKELO and GOMBE (1982) have also reported a vaginal closure membrane in the cane rat.

Material and methods

18 *T. swinderianus* ♀♀ kept in single cages (0,5 × 0,5 × 0,5 m) next to each other were used for observations. The animals were held in the Centre Beninois d'Élevage d'Aulacodes (CBEA) in Godomey, 10 km west of Cotonou, RP Benin. In order to inspect the anogenital region the animals were lifted by their tails so that the front legs still touched the ground (MENSAH 1985).

The following classifications were chosen to describe possible recurring changes of the vaginal phases:

Vagina: wide open – open – closed by vaginal scab – tightly closed

Colouration: distinctly red – normal

Vulva: swollen – normal

Vaginalflow: secretion – no secretion

The periods of observation of the anogenital region were from 16. 7. till 12. 8. 84 (two inspections daily, at 9 a.m. and 3 p.m.) and from 13. 8. till 5. 9. 84 (four inspections daily at 8 and 12 a.m. and 4 and 8 p.m.). Data was collected on 52 consecutive days in all.

Experiments were made in which one ♀ was placed in a ♂ cage. A pasteur pipette was used to flush the vagina with salt solution (0,3 % NaCl).

The vaginal smears were stained using Giemsa's solution. Females with open vaginas and secretion were tested to see if they would show a lordose-reaction when the bag was stroken.

Results

Neither the observations made of the anogenital region of the cane rat in order to demonstrate changes in the vulva, nor those made during the taking of vaginal smears, could at any time, on any of the animals, confirm the existence of a vaginal closure membrane as defined by STOCKHARD and PAPANICOLAOU (1919).

A substance was however observed, which hardened out of a mucous vaginal secretion to form a kind of scabby plug, similar to the scab on a wound.

In the case of the cane rat, it seems that the term "vaginal-scab" would be useful for describing this sort of plug.

Observations were made in order to establish a possible connection between the appearance and disappearance of a "vaginal-scab" and oestrous cycle of *T. swinderianus*. During the 52 days of observation 9 of the 18 ♀♀ showed the vaginal phase "open vagina" more than once (s. Table).

Table shows that the time intervals between "open vagina" and "open vagina" are irregular and differ largely from animal to animal for the 9 ♀♀ displayed this condition more than once. The large standard deviation in the time intervals observed should also be emphasised.

Routinely taken smears of 5 ♀♀ showed no clear sequence of different cell elements in the slide preparation. This was in contrast to vaginal smears taken from *Rattus spec.* for example. Epithelial cells were observed infrequently, and in these cases as fragments, if at all. The epithelial cells were with or without nucleus.

When much mucous secretion was produced, the percentage of leucocytes was strikingly high. Leucocytes always appeared in the slide preparations but in varying concentrations. These different observations, made over a period of 30 days (at 9 a.m. and 4 p.m.), could not be brought into any meaningful correlation with the events observed in the vulva.

The experiments in which ♀♀ with "open vaginas" were placed together with ♂♂ in males cages provided no evidence for copulation readiness in the ♀♀. Copulation was not observed. No sperms were found in vaginal smears taken from ♀♀ that had been placed in a males cage overnight. No lordose-reaction could be observed when ever tested.

Some animals were observed for a period of 6 days during which inspections were made every 15 minutes over the entire time interval between two normal observations. This

made it possible to check for any changes in the anogenital region, which would otherwise not have been registered. Animals which had a "closed vagina" without "swollen vulva" and without any "secretion" were found in some cases to have an "open vagina" after 15 minutes. In other cases animals with a "vaginal scab" were found to have sloughed it off after 15 minutes in which case the vagina could either be "open" or "closed".

Table
Observation of the vaginal phase "open vagina"

Time interval between "open to open" in days	Standard Deviation	No. of observations of "open vagina"
4,5	2,9	4
3,0	1,3	3
9,6	3,8	3
4,6	4,5	8
11,1	4,3	2
8,0	6,3	4
9,9	8,5	3
5,9	3,4	5
3,0	1,7	3
$\bar{x} = 6,62$	$\bar{Sx} = 3,1$	$n = 35$

Discussion

No correlation could be found between oestrous and changes in the anogenital region of the cane rat. These results are in contrast to those reported for the guinea-pig. The presence of a vaginal closure membrane of epithelial origin, as described by KELLY and PAPANICOLAOU (1928), could not be confirmed for *T. swinderianus*.

Our own examinations confirm the observations of STOCKHARD and PAPANICOLAOU (1919), who describe how mechanical irritation of the vaginal closure membrane leads to pain response in the guinea-pigs. Cane rats however tolerated the introduction of pasteur pipettes (1–2,5 cm deep), which were used to obtain vaginal smears. It was even possible to introduce the pipettes into a "closed" vagina. The animals showed no signs of pain, as would have been the case if a vaginal closure membrane had been destroyed.

At no stage during the 52 days of observation, did the authors notice anything similar to a vaginal closure membrane in the 18 ♀♀ which took part in examination.

STOCKHARD and PAPANICOLAOU (1919) have postulated that the presence of a vaginal closure membrane is a reliable sign for a particular condition of the oestrous cycle of the guinea-pig.

In the cane rat the appearance of a "vaginal-scab", and the opening of the vagina accompanied by mucous secretion do not allow any conclusions concerning a definite correspondence between copulation readiness and the degree to which the vagina has opened. Neither could a connection between copulation readiness and the presence of a vaginal-scab be established. The degree to which the vagina had opened and the presence of a "vaginal-scab" could so far not be associated with any particular stadium of oestrous.

Cytological staining after PAPANICOLAOU (BURCK 1982) could possibly show physico-chemical changes more clearly in the vaginal smears than Giemsa's solution does, which we used. This would possibly provide access to more accurate knowledge about the female's reproduction cycle.

So far the oestrous length of the cane rat is still unknown. Further investigations are necessary to solve this question.

ASIBEY (1974) who reported a vaginal closure membrane in ♀♀ used its existence as a criterion of pregnancy in the cane rat. At the C.B.E.A. attempts were made to determine the gestation-length by looking for a vaginal closure membrane or a closed vagina during this period. We were not able to observe a vaginal-plug, a closed vagina or a vaginal closure membrane as a reliable criterion over, what we estimated, the 152 days of gestation. The gestation-length was found out by controlled experiments in which a ♀ was placed in a male's cage. After separation the days were counted until the ♀♀ gave birth (MENSAH 1985). Probably ASIBEY noted the "vaginal-scab" as a vaginal closure membrane which is as far as we see a different structure which occurs in variable time intervals in pregnant and nonpregnant ♀♀.

In contrast to THENIUS (1980) CARLETON (1984) puts the cane rat in the Suborder Hystricognathi, the Infraorder Phiomorpha and gives them their own Superfamily Thryonomyoidea which contains the Thryonomyidae and Petromuridae.

In four old-world species which belong to Hystricognathi two species (*Hystrix cristata*, *Heterocephalus glaber*) do have a vaginal closure membrane (WEIR 1974). As far as we know no vaginal closure membrane could be found in the dassie-rat (*Petromus typicus*), or no attempt was undertaken to find one in this rodent. For *Thryonomys swinderianus* we can not confirm the existence of a vaginal closure membrane.

On the other hand 26 of the 29 observed members of the Hystricognathi species which should have a vaginal closure membrane (WEIR 1974) are new-world species.

The relationship between old- and new-world species of hystricomorphous rodents is still uncertain. Aspects of reproduction biology and construction of the reproduction organs might help to cast a new light on the difficult classification of the Order Rodentia.

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Zusammenfassung

Zur Fortpflanzungsbiologie von Thryonomys swinderianus (Temminck)

Fortpflanzungsbiologische Untersuchungen an weiblichen Rohrratten führten zu der Annahme, daß, im Gegensatz zu anderslautenden Hinweisen in der Literatur, eine vaginale Verschlussmembran nicht vorhanden ist.

Veränderungen an der Vulva sowie das periodische Auftreten von Vaginalgrind konnten in keinen Zusammenhang mit dem Östrus gebracht werden.

♀♀ mit „offener Vagina“ und „Sekretion“ zeigten keine Lordose-Reaktion.

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Zur Nahrungsökologie des Luchses *Lynx lynx* in den schweizerischen Nordalpen^{1,2}

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Abstract

*Feeding ecology of the lynx (*Lynx lynx*) in the Swiss Alps*

Collected data about feeding habits of radiocollar-fitted lynxes (*Lynx lynx*) in the northern Alps from 1983 to 1985. Lynxes in the study area fed mainly on the two smaller ungulates. 88 prey items were found: 48 roedeer, 30 chamois, 5 hares, 2 domestic sheep, 2 marmots and 1 red squirrel. Analyses of faeces showed that neither small rodents nor birds are of any importance as lynx prey. A male and a female hunting in the same area showed different preference in killing roe-deer and chamois (12:14 and 21:7 resp.). Distances between consecutive kills varied from 5 to 10 km. Exploitation of killed ungulates in undisturbed sites was 88 %, close to civilization 62 %. Adult lynxes killed 1 ungulate every 6.6 days, a female with two cubs of 10 months 1 every 2.7 days. The yearly consumption of 1 lynx is estimated to be 60 roe-deer or chamois, and the total consumption in the study area 3 %–9 % of the ungulate population. Feeding strategy (surprise attack) is one of the main reasons for the large home ranges and the low population density of the lynx in the northern Alps.

Einleitung

Im 19. Jahrhundert war es um die Wildbestände in der Schweiz schlecht bestellt: Reh und Hirsch waren fast ausgerottet, der Steinbock in den Nordalpen seit langem verschwunden. Einzig die Gemse hatte – wenn auch in geringerer Zahl als heute – in den Alpen überlebt. Das Verschwinden der Paarhufer entzog den großen Prädatoren und Aasfressern (Bär, Wolf, Luchs, Steinadler, Bartgeier) die Nahrungsgrundlage und zwang sie zu vermehrten Übergriffen auf Haustiere, was ihre Bekämpfung verstärkte und erleichterte. Der intensiven Nachstellung mußte auch der Luchs weichen (EIBERLE 1972). Im Laufe des 20. Jahrhunderts kehrte das Schalenwild (durch Hegemaßnahmen und Wiederansiedlungen geför-

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